Title: The Absolute Truth

Brief Overview:

> Students will use an activity sheet, mathematical reasoning, and a graphing calculator to find and check solutions to absolute value inequalities. Students will use the activity sheet, a homework assignment, and a writing assignment to communicate their understanding of the methods available to find and check solutions to absolute value inequalities.

Links to Standards:

- **Mathematics as Problem Solving**
  The students will apply knowledge of the absolute value inequalities to real-world situations.

- **Mathematics as Communication**
  The students will be able to communicate the method used to solve the inequalities on the activity sheet as well as a summary of the algebraic method in a letter.

- **Mathematics as Reasoning**
  The students will predict solutions to absolute value inequalities and verify those solutions with the table function of the graphing calculator.

- **Mathematical Connections**
  The students will recognize that the absolute value functions can be represented as compound inequalities.

- **Algebra**
  The students will use operations and interpret tables to find solutions to absolute value inequalities.

- **Functions**
  The students will translate solutions to graphical representations.

- **Technology**
  The students will use the table function of the graphing calculator to determine solutions and use the graphing function to check solutions to absolute value inequalities. The unit is designed to make use of the TI-83 graphing calculator. The activity sheet may need to be adjusted to accommodate different graphing calculators.

- **Mathematical Structure**
  The students will understand the logic of algebraic procedures.

Links to Maryland High School Mathematics Core Learning Goals:

- **1.1.1:** The student will recognize, describe, and extend patterns and functional relationships that are expressed numerically, algebraically, and geometrically.

- **1.1.2:** The student will represent patterns and functional relationships in a table, as a graph, and/or by mathematical expression.

- **1.2.2:** The student will solve linear inequalities and describe the solutions using numbers, symbols, and graphs.

Grade/Level:

Grades 8-12

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

• Solving linear equations in one variable
• Solving absolute value equations in one variable
• Solving compound equations and inequalities
• Graphing solutions of equations and inequalities on a number line
• Using a TI-83 graphing calculator

Objectives:

Students will be able to:

• solve inequalities with one absolute value in one variable algebraically.
• graph the solutions on a number line.
• use the table and graphing functions of the TI-83 to verify answers.

Materials/Resources/Printed Materials:

• Drill, Activity, Homework, Classwork, To Tell the Truth
• TI-83

Development/Procedures:

Day 1:

• The students complete a drill which reviews previous necessary information. Answers are discussed with the teacher calling on various students. If there are questions, those problems are shown on the chalkboard.

• The activity sheet and the calculators are handed out to each student. The students work on the activity sheet in their cooperative learning groups. The teacher circulates the classroom throughout the activity for reinforcement, as well as accuracy.

• Group reporters show the correct solution to one of the inequalities, chosen by the teacher, on the chalkboard. The teacher leads a general discussion of how the solution of an absolute value inequality relates to conjunction statements (and/or). Students keep the activity and homework is assigned.

• Students hand in the activity and the homework.

Day 2:

• Classwork and the calculators are handed out. Students work on Part I individually, and use the TI-83 to check their answers as well as work on Part II in their cooperative learning groups. The teacher circulates the activity for reinforcement.

• Group reporters present the solutions to Part II orally. Students receive To Tell the Truth to do at home.

Performance Assessment:

- A group evaluation will be based on performance, time on task, quality of discussion, and completion of the activity .

- The homework and To Tell the Truth are evaluated.

Extension/Follow Up:

- The students will use the techniques developed in this unit to solve inequalities containing more than one absolute value.

- The students will use what they have learned to develop an inequality problem from their own experience and explain the process used to solve inequalities.

Resources:

http://www.dc.peacnet.edu/~mhall/mypage/caculat/abineq.htm

Bellman et al., Algebra, Prentice Hall, 1998

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#1A. List and graph all possible solutions for x in the following:

a. $|x| > 3$ b. $|x-5| < 4$

c. $|x| + 3 > 9$ d. $|x+3| - 2 < 0$

B. Describe the method you used to find the solutions.

#2. Follow the directions to find and check the solutions for
the inequalities a - d on the TI-83.

•Enter the side of the equation with the absolute value into Y1. To do so,
you will enter the expression inside the absolute value as abs( ). The
function is entered by pressing MATH, arrowing over to NUM and pressing 1
(abs( )).
•When that side of the equation is entered, display a table of values by
going to TBLSET (Table Set), which is found as the second function of
WINDOW. Set an appropriate start (-20) and   Tbl (1). Auto should be
highlighted for both Indpnt and Depend.
• Now look at the TABLE (2nd GRAPH) and use the down arrow key to
determine solutions to the inequality. Again, find and graph all solutions.

#3. Now that you know the solutions, show a way to find them
algebraically for each inequality a - d.

DRILL

Solve and graph, show all work :

1) $x < 4$ **or** $x \quad 6$ **2)** $-2 \quad y < 4$

3) $m - 5 \quad 2$ **and** $m + 7 > -2$ **4)** $2x + 1 < 5$ **or** $3x - 2 > 7$

5) $11 < 2y + 3 < 5$ **6)** $5n - 4 < 21$ **or** $7n + 12 > 26$

7) $-3 < .5x + 2 \quad 6$ **8)** $|-4| = m$

9) $x = |2|$ **10)** $z = |-.75|$

HOMEWORK   NAME _____

                                        DATE _____

For each of the following situations define a variable and write
a compound inequality to describe it.

1.   The highest temperature in Anne Arundel Co. was 103 degrees
     this June while the lowest temperature was 45 degrees.

2.   According to Julie's bank she is not allowed to write any more
     than 60 checks a month.

3.   Ben's income is between $45,000 and $65,000.

4.   Richard and his wife Denise plan to have at least one child but
     no more than 4 children.

For each of the following choose a variable and write an
absolute value inequality that represents the set of numbers on
a number line.

5.   All numbers no more than 6 units from 0.

6.   All numbers at least 515 units from 0.

7.   All numbers no more that 21 units from 15.

8.   All numbers more than 7 from 19.

Express each absolute inequality as a compound inequality.

9. $|x| > 12$

10. $|y-2| < 5$

11. $|5z-4| > 16$

12. $0 < |3n-1|$

HOMEWORK CON'T.

Express each of the following compound inequalities as an
absolute value inequality.

13.   -8 < n < 2

14.   - 2 > k or k > 2

15.   m-3 < 5 and m-3 > -5

16.   X is greater than 4 and less than -4.

OPEN-ENDED

17.   Describe a real-life situation that you could represent with
       the inequality -2 < h <10.

18.   Write an absolute value inequality for the information in
       problem # 17.

CLASSWORK

Name

Date

Express each absolute value as a compound inequality, solve, and graph on a number line.

1) $| n | > 2.7$

2) $- 5.2 < | y |$

3) $| x - 2 | > 8.2$

4) $15 < | 2c - 6 |$

5) $| 3y + 4 | < 13$

6) $8 > | 2k -12 |$

Follow the directions on the TI-83 and check the solutions to the graphs in problems 1-6.

- •Enter the inequality into Y1. To enter the inequality symbol go to TEST, which is the second function of MATH, then choose the appropriate symbol.
- •When the inequality is entered, press GRAPH. If you do not see the graph, press ZOOM 6 to get a standard viewing window.

7) Nancy bought a new tennis racket and two cans of balls, and paid at least **110** dollars for the purchase. If Nancy paid ten more than nine times as much for the racket as for the balls, how much must she pay for the balls?

   a) Write the algebraic form of this inequality.

   b) Solve this inequality .

   c) Could Nancy buy the tennis balls for $ 9.50 ?

   d) Write an explanation for your answer to part **c.**

8) If Angela knocked down three more pins on her last ball, her score would have been between 175 and 180.

   a) Write an algebraic statement for this inequality.

   b) Find the number of pins she knocked down prior to her last ball.

9) The range of scores for a B grade on the last math quiz was 17 to 15 inclusive.

   a) If Tom's score was at most 2 less than twice Mary's score of 6, did he earn a grade of B?

   b) What is the lowest score Mary could make for Tom to get a B grade on the quiz?

TO TELL THE TRUTH

Write a letter to a friend describing an example of a real-world situation that involves a compound inequality. Write the inequality as an absolute value inequality. Solve and graph the solution, and explain to your friend how you arrived at your answer.

RUBRIC
To Tell the Truth

2 Correct example of a real-world situation involving a compound inequality.

2 The situation written correctly as an absolute value inequality (1 point if written incorrectly).

2 The inequality is solved correctly.

2 The solution to the inequality is graphed correctly.

2 A correct written explanation is included.

_____

10 points total